

FEP OUTPUT FORMAT

TELEMETRY DATA DISTRIBUTION ~~OBJECT~~PACKETS

OVERVIEW

Telemetry data ~~received directly from the FEP will be delivered via telemetry packet objects.~~ ~~The format for these objects processed by the CCS Front-End Processor (FEP) will be delivered to direct recipients in telemetry packets.~~ The format for these packets and the data they contain is referred to as the FEP Output Format (FOF). ~~The Common Data Format (CDF) used to provide requested data to users and applications is similar to Data produced by the Front End Processor is similar to Common Data Format (CDF)~~ the FOF with the following differences: (1) the CDF Header ~~Object~~Record contains only one time field, the Spacecraft Time; (2) the CDF Element ~~Object~~Record contains an 8-character Mnemonic ID and the FOF does not; and (3) the ~~FOF~~ Element Record contains both the raw and EU-converted values in separate fields while the CDF EU Value in the CDF Element Object can have different formats as indicated by an EU Type field ~~contains only one field that can hold either one (if both are desired, two CDF element records would be required).~~ The two additional time fields in the FOF ~~Header Record~~ are used for the merge process, but are not archived with the telemetry.

An Application Program Interface (API) will be provided to isolate users of the data from format concerns. The API will contain all the necessary methods for extracting data and presenting it to the user.

DETAILS

Each telemetry ~~object~~packet consists of a ~~single telemetry data packet.~~ ~~Each packet will consist of a~~ header ~~object~~record containing meta-data about the packet followed by telemetry element ~~object~~records. Each telemetry element ~~object~~record contains one spacecraft telemetry or derived parameter in both raw and Engineering Unit formats, along with its numeric identifier and associated flags.

There is a packet for each unique spacecraft time for which telemetry data is received. For 4 Kbps telemetry, this is one packet per minor frame; for 32 Kbps data, it's two packets per minor frame. This is because 32-Kbps minor frames are read into spacecraft computer memory in two halves. Thus while minor frames are generated at 20 Hz, the actual data sampling occurs at 40 Hz.

The data stream consists of a sequence of packets each consisting of a header record corresponding to a specific spacecraft time followed by a telemetry element ~~object~~record for each decommutated parameter sampled at that time.

Descriptions of the Telemetry Data ~~Object~~Records are provided in the Table1 below.

Table 1. Definitions of Fields in the FOF

Item Name	Bit Size	Type	Item Description
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Item Name	Bit Size	Type	Item Description
FOF Packet Header <u>ObjectRecord</u>			
Spacecraft Time	64	IEEE Flt. Pnt.	Time defined by the vehicle clock count converted to UTC and expressed as modified Astronomical Julian Day. For test data, this field will contain CCS Time when presented to the user if the data capture process was configured to store the data by CCS time during the test.
NGT Receipt Time	64	IEEE Flt. Pnt.	UTC of time NGT transmitted the data to CCS expressed as modified Astronomical Julian Day
CCS Receipt Time	64	IEEE Flt. Pnt.	UTC of time data was received by CCS expressed as modified Astronomical Julian Day
Number of Elements	16	positive integer	Number of Telemetry Element <u>ObjectRecords</u> in the packet
Data Source	8	bits	Identifies various characteristics of the data source as shown in Table 2.
Telemetry Format	8	positive integer	Identifies telemetry format. Integer codes between 0 and 255 will be assigned to all existing formats as shown in Table 3. Additional codes will be assigned for new formats as necessary.
FOF Element <u>ObjectRecord</u>			
Numeric ID	16	positive integer	Unique identifier for the parameter
Raw Value	32	raw Tlm. bits	Parameter raw value as stored by the spacecraft
<u>EU Type</u>	<u>8</u>	<u>ASCII</u>	<u>Indicates the format of the EU Value field; F = 4-byte float; D = 8-byte double precision; C = 8-byte character. NOTE: the requirement for double precision has not been established and is being included for possible future expansion.</u>
<u>EU Value</u>	<u>32 or 64</u>	<u>IEEE Flt. Pnt.</u>	<u>Parameter value converted to engineering units.</u>

Item Name	Bit Size	Type	Item Description
Flags	16	bits	Associated flags (see Table 4)

Notes

1. Numeric ID: This is a unique integer assigned to each telemetry point for the life of the mission even if the point is eliminated.
2. Data gaps are identified in two ways. At the data stream level, a Boolean pseudo-parameter is used that indicates data presence or absence. The gap pseudo-parameter is set to 1 if no data is received for a period of time greater than some threshold which could be one minor frame interval or some longer period of time (**TBD**). The gap pseudo-parameter will change value at the beginning and end of each contiguous data span. At the element level, the Initial Point Flag and Final Point Flag indicate the beginning and end of contiguous data spans for a single element. There may be a gap in an element, even though the gap pseudo-parameter never indicates a gap in the data stream, if a portion of a minor frame is lost. It remains to define the interval thresholds used to set the gap flags and the gap pseudo-parameter. The precise definition of a data gap is **TBD**.
3. The data source flags are all set in the FEP and are transferred from the FOF to the CDF unchanged.

Table 2. Definitions of Flags in the FOF/CDF Header Data Source Field

BIT	FLAG NAME	DESCRIPTION
0 (lsb)	Spacecraft Data Mode	0 indicates recorded data (ETR/SSR) 1 indicates Real-Time data
1	Ground Station Mode	0 indicates direct feed through ground station 1 indicates replay of ground station recorded data
2	CCS Mode	0 indicates operational data 1 indicates test data
3	FEP Mode	0 indicates external data source 1 indicates FEP is replaying pre-recorded data for testing
4	FEP Replay	Set to 1 if data is being supplied in response to an FEP replay request
5	Era	0 if data was captured by CCS 1 if data was converted AEDP/ESS data
6-7	Spare	

Table 3. Telemetry Format Identifier Code Definitions for the FOF/CDF Header

Code	Format
0	off
5	XN
6	XF
24	TN
25	TF
36	HN

Code	Format
37	HF
40	FN
41	FF
48	C
64	YN
65	YF

Code	Format
80	PN
81	PF
82	NSSC-1 Dump
138	M
145	S
146	D/E

Code	Format
163	U
186	ZN
187	ZF
192	AN
193	AF
others	spare

Table 4. Definitions of Flag Bits in the FOF/CDF Element Flags Field

BIT	FLAG NAME	SET BY	DESCRIPTION
0 (lsb)	Corrected Spacecraft Time	FEP and Merge	Set to 1 if VCC was bad and S/C Time has been corrected; also used for D/E format data
1	Quality	FEP	Set to 1 if data quality is questionable
2	Limit Low	FEP	Set to 1 if out of limits low
3	Limit High	FEP	Set to 1 if out of limits high
4	Limit Level	FEP	Set to 1 if beyond severe limit (red)
5	Delta Error	FEP	Set to 1 if delta limit exceeded
6	Alternate limits	FEP	Set to 1 if alternate limits should be used
7	EU Conversion Error	FEP	Set to 1 for conversion error
8	No EU Conversion	FEP	Set to 1 if no EU conversion is defined in the PRD for this element
9	Initial Point	FEP	Set to 1 if first point after gap, start of contiguous span
10	Final point	Merge	Set to 1 if last point before gap, end of contiguous span
11	Reconstructed Point	Data Mgt	Set to 1 if this point was added to "changes only" data to construct "all points" data.
12-15	Spare		